Graphics and Imaging Overview

Session 500

Graphics and Imaging Overview

Peter Graffagnino
Director, Graphics and Imaging Engineering

Agenda

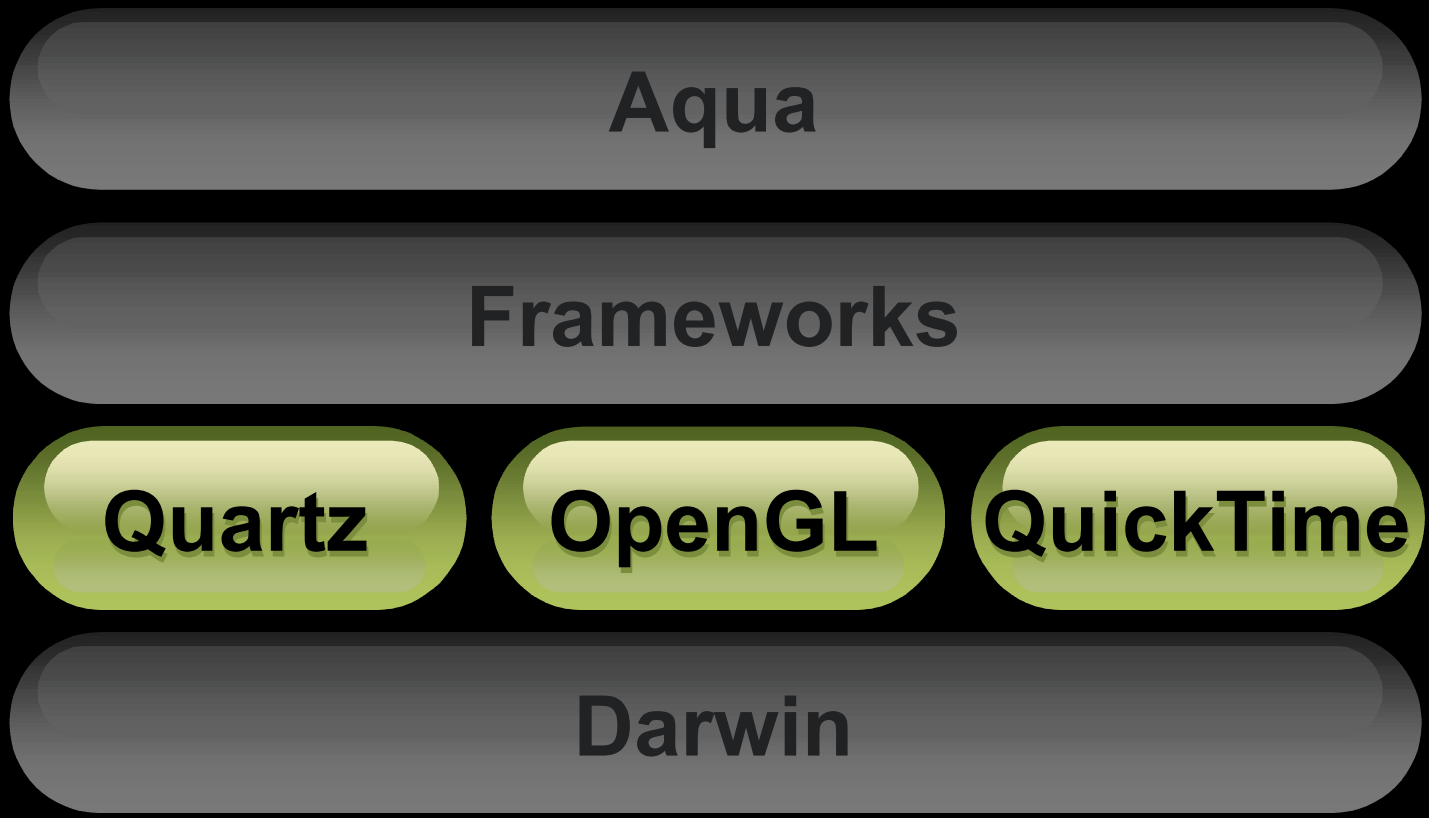
- Technologies:
  - Quartz2D
  - OpenGL
  - Quartz Compositor
  - ColorSync
  - ImageCapture
  - Printing
- Brief overview of technology
- What's new in Jaguar

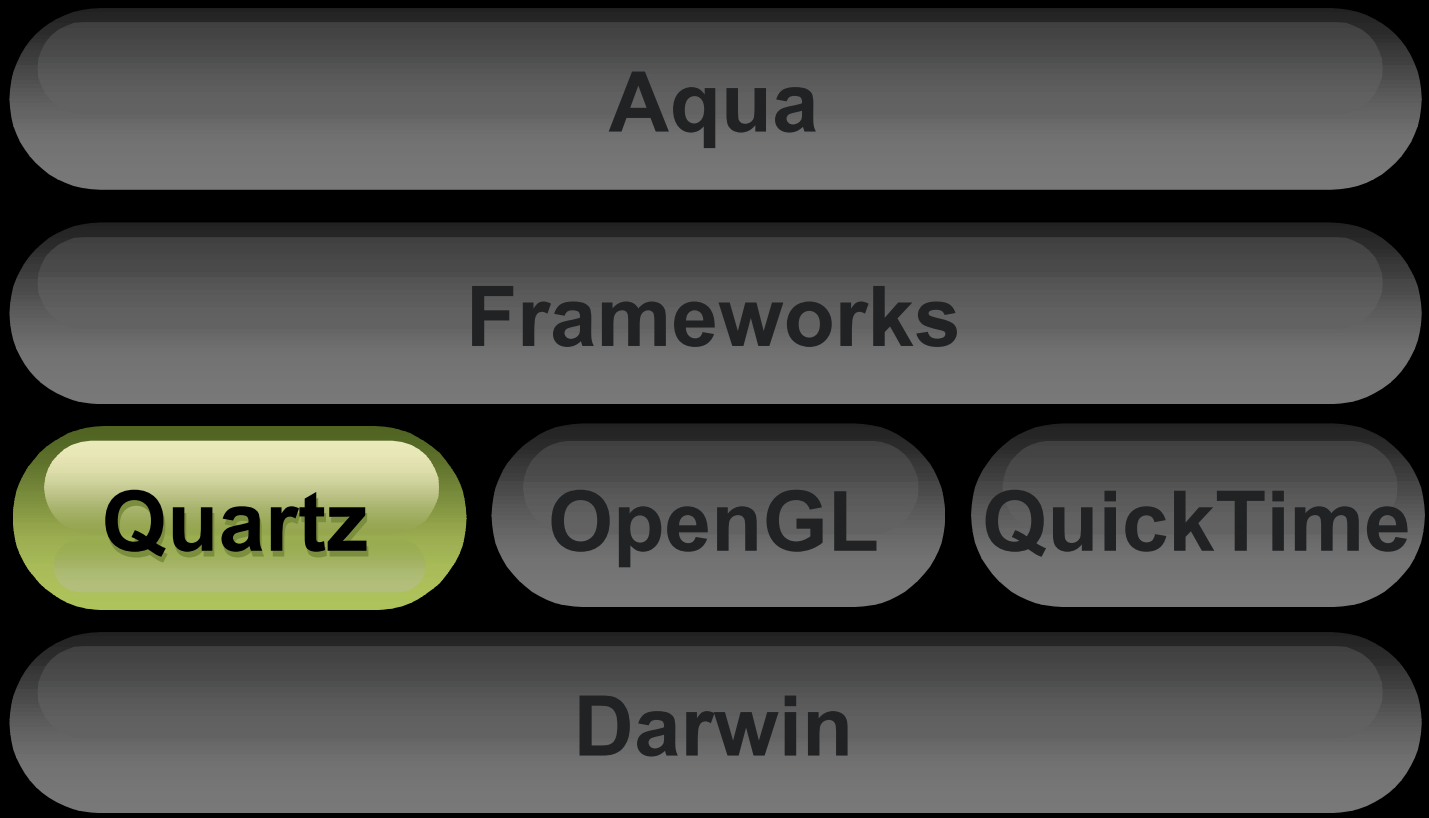
Aqua

Frameworks

Graphics

Darwin


Aqua
Frameworks
Quartz
OpenGL
QuickTime
Darwin


Aqua
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OpenGL
QuickTime
Darwin

Industry Standard 2D Imaging Model

Quartz 2D

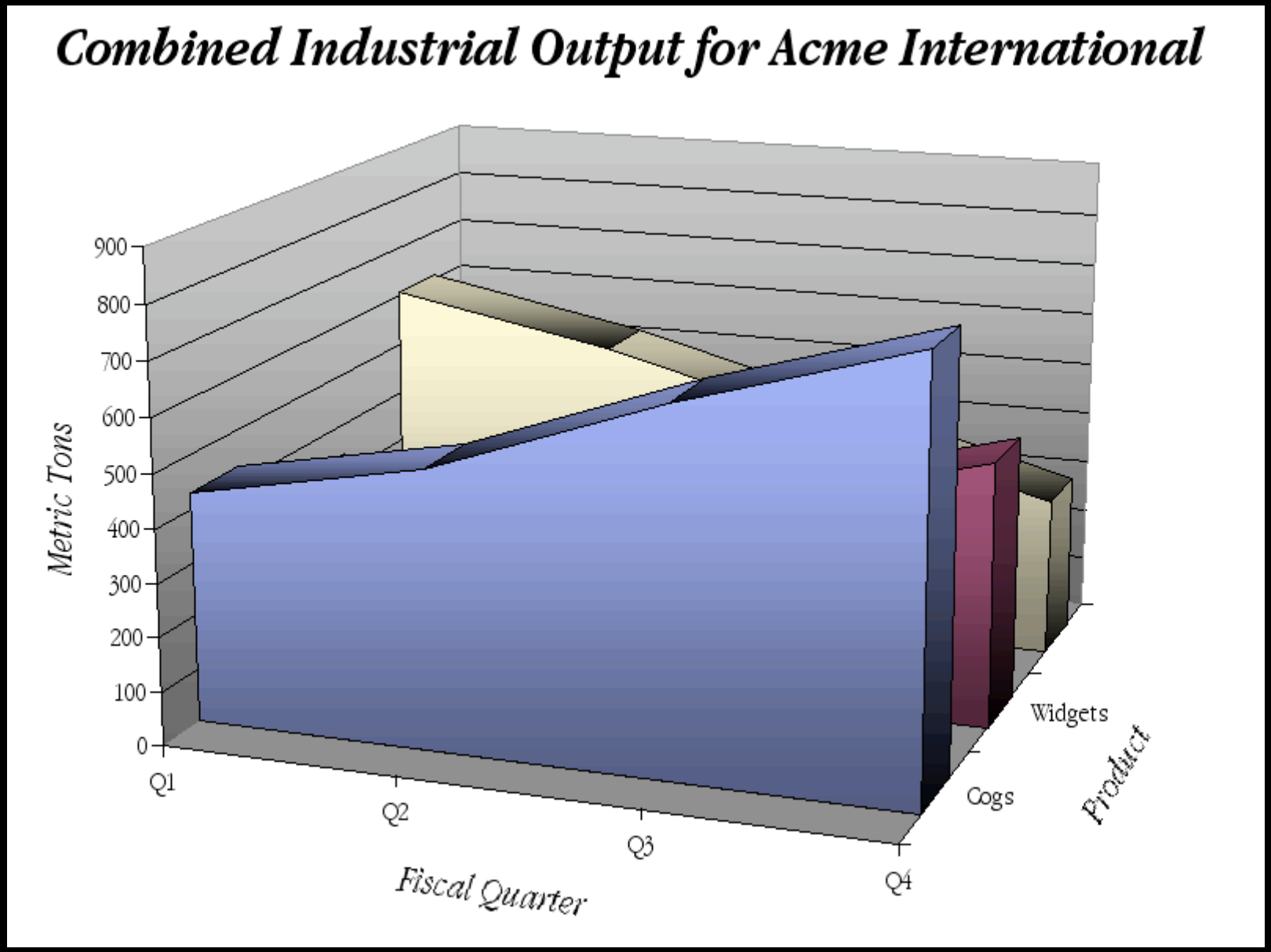
- Lightweight C Library
- Read/Write PDF
- Fast Anti-aliasing
- Destination Alpha
- Apple Type System built-in
- Type 1 Scaler built-in
- ColorSync built-in

What's New in Quartz 2D

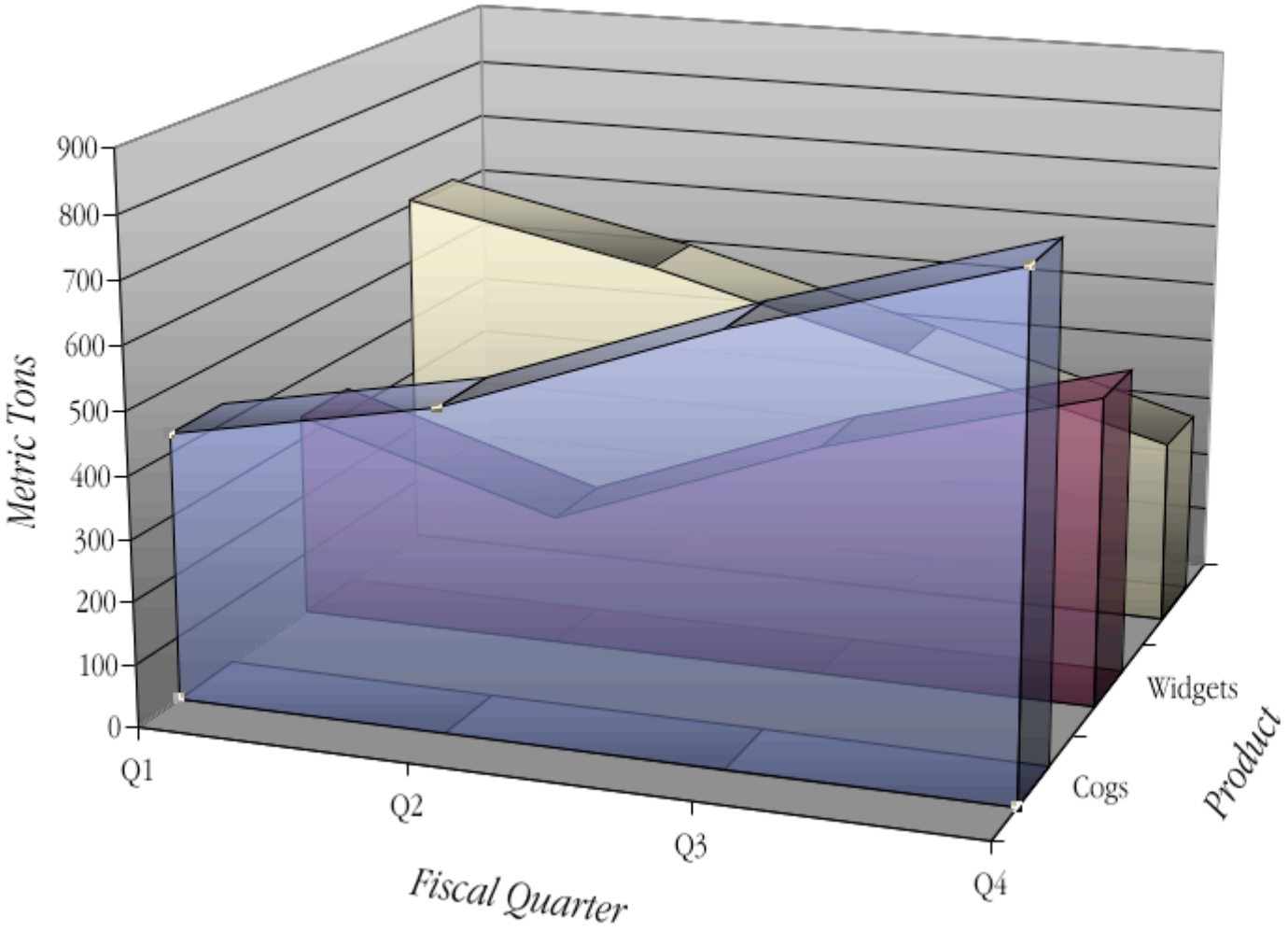
- Full PDF 1.3 support
- Gradients and patterns
- Transparency in PDF
- PDF X/3 support
- PICT rendering with Quartz 2D
- QD text rendering with Quartz 2D

Quartz 2D and Carbon

- Can mix QuickDraw and Quartz 2D


Combined Industrial Output for Acme International
900
800
700
600
500
400
300
200
100
0
Metric Tons
Q1
Q2
Q3
Q4
Fiscal Quarter
Widgets
Cogs
Product

Combined Industrial Output for Acme International

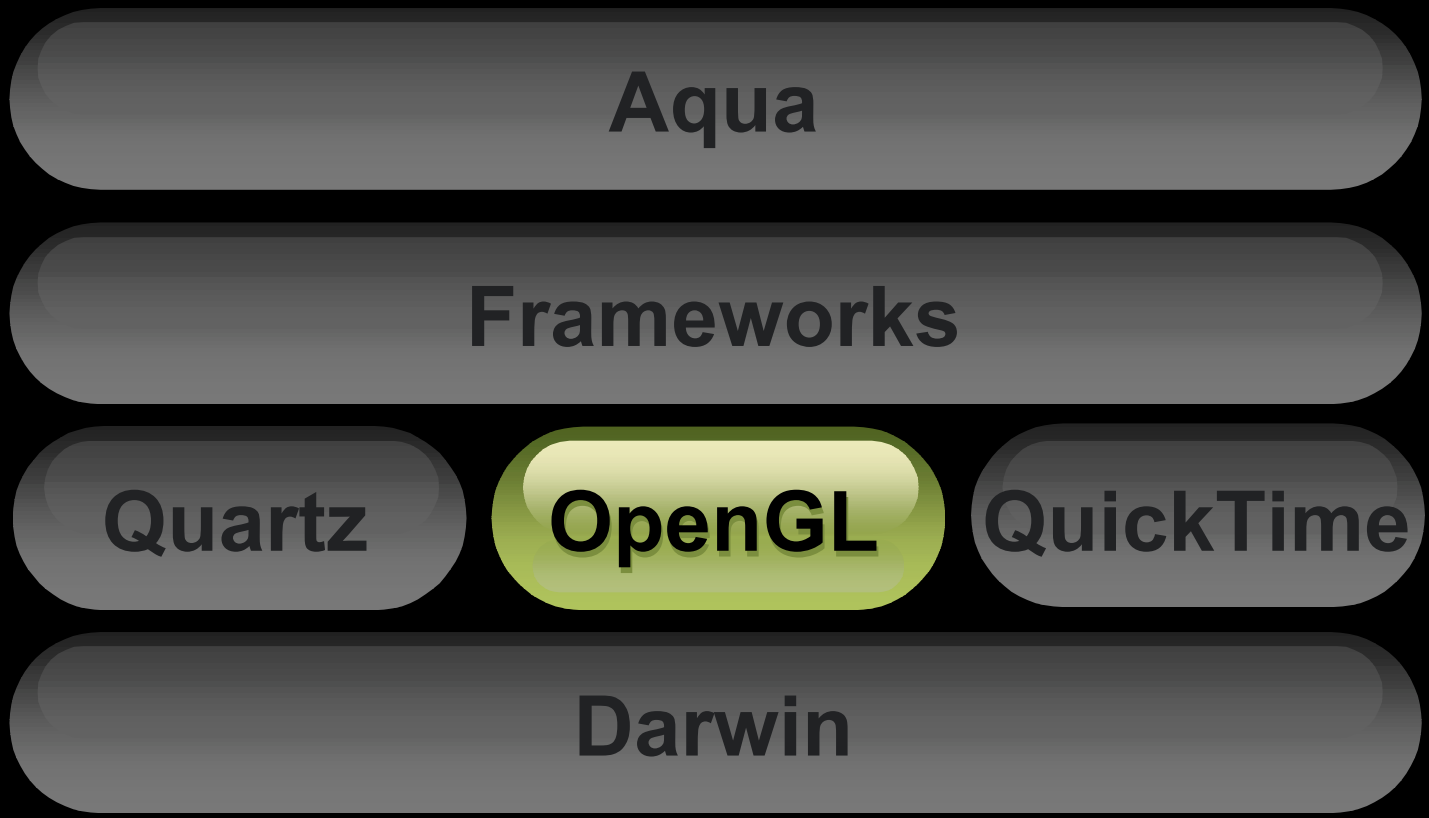


Moving to Quartz 2D

- PICT rendering with Quartz 2D
- QuickDraw text rendering with Quartz 2D

Quartz 2D Roadmap

501 Quartz 2D and PDF Update on Quartz 2D APIs	Room A2 **Tue., 2:00pm**
509 ColorSync and Digital Media ColorSync update	Room C **Wed., 5:00pm**
516 Graphics and Imaging Performance Tuning	Hall 2 **Fri., 3:30pm**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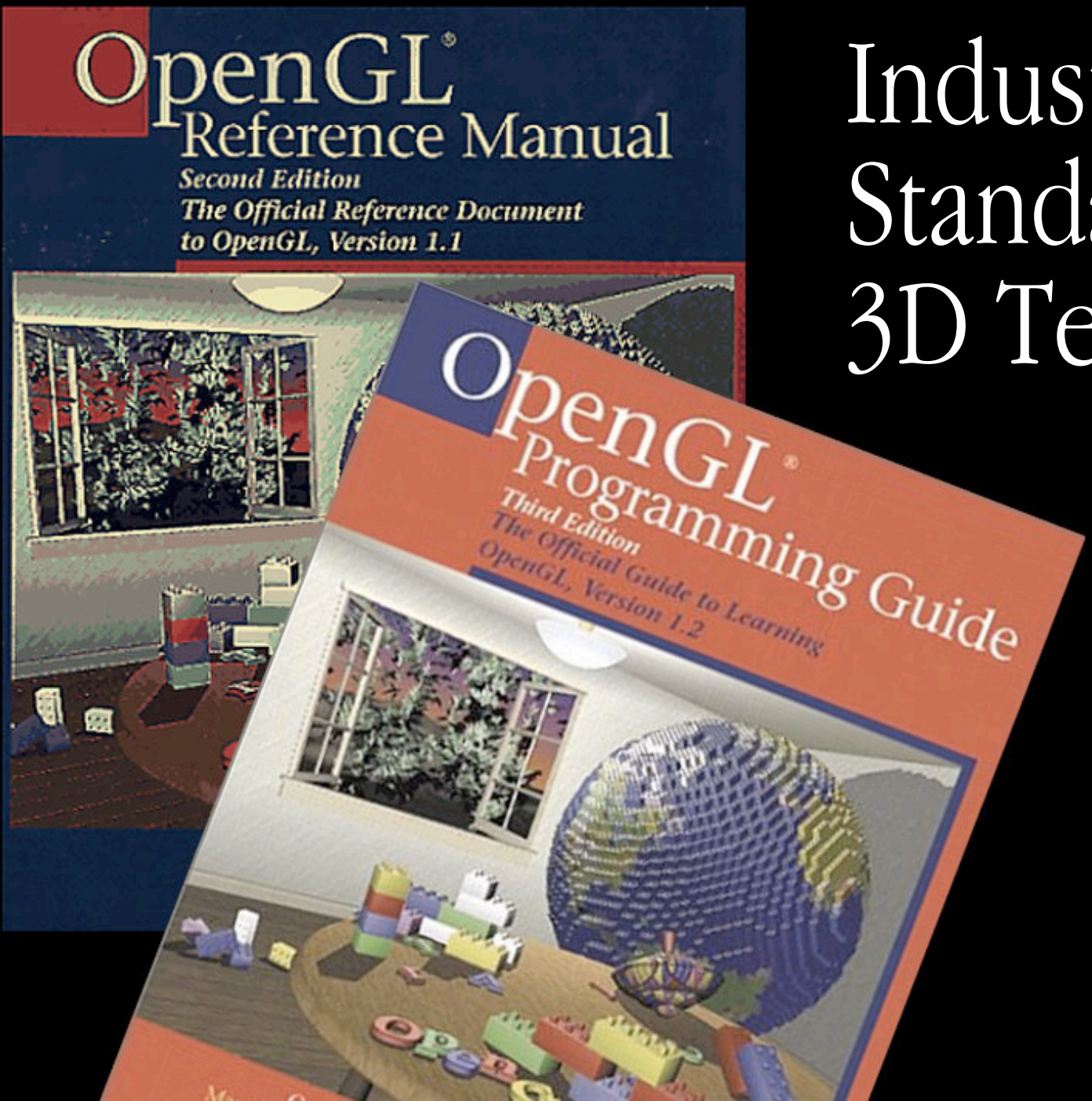


Industry Standard 3D Technology

nVIDIA

ATI TECHNOLOGIES INC.

Demo


ARB

Not Just for Games

kaydara

Maya

Alias | wavefront

Demo

Mac OS X OpenGL

- State-of-the-art architecture
  - Resource virtualization
  - Data flow optimizations
  - Overlays through semi-transparent windows
- Apple co-develops drivers
  - Single stop shopping for developer issues
  - Can respond quickly to developer requests
  - Maintain consistence across product line

OS X OpenGL

- Apple has good visibility into 3D hardware
  - Apple can help push your requests into hardware
  - Apple can find unique solutions to your needs
- Apple taking a leadership role in OpenGL ARB

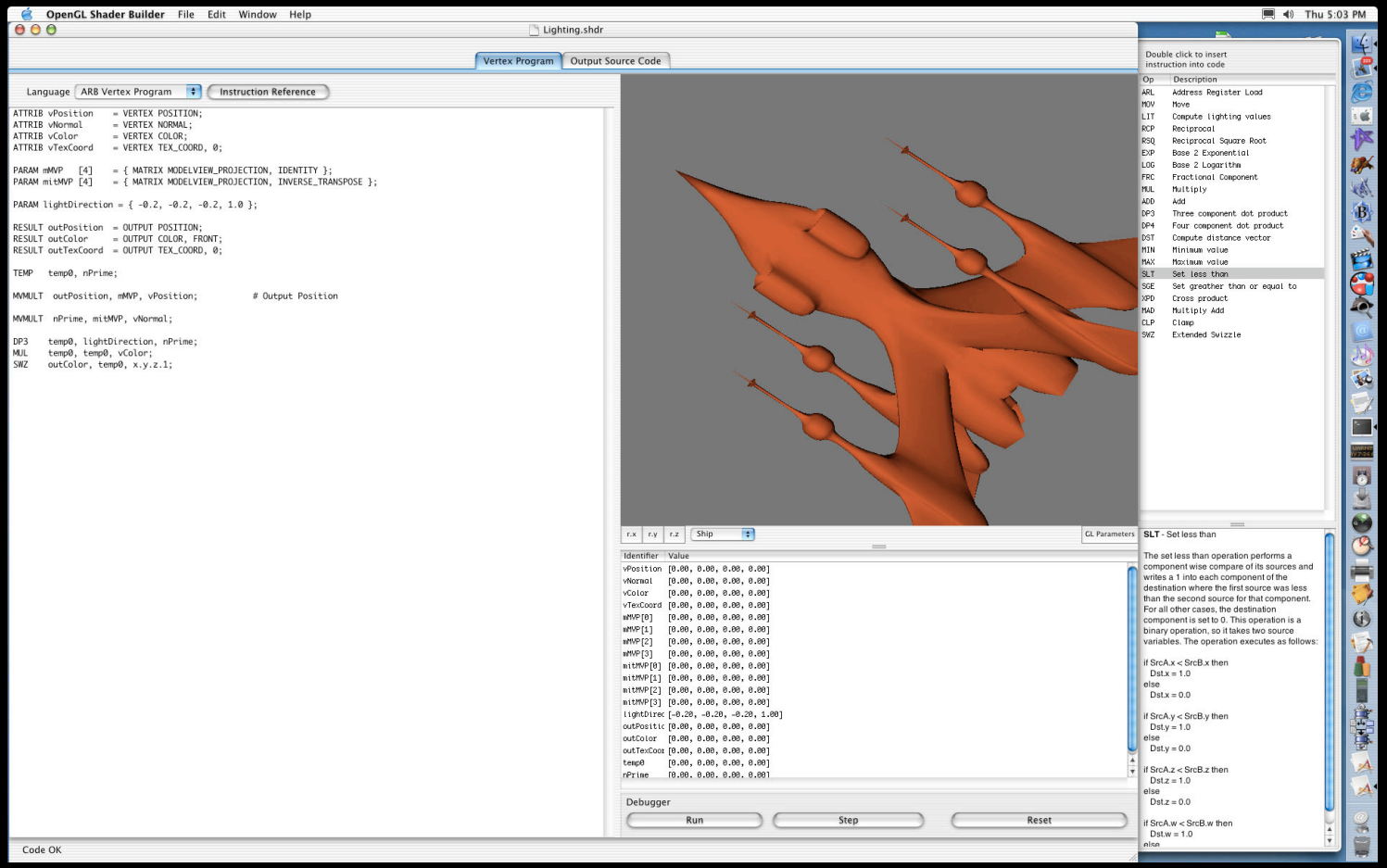
What's New in OpenGL

- Programmable Shaders
- System Integration
- Texture upload performance
- Lots of extensions
- Amazing new Tools

Programmable Shaders

- Vertex Shading based on:
  - **GL_ARB_vertex_program**
- Pixel and Texture shading based on vendor-specific extensions:
  - **GL_NV_texture_shader[123]**
  - **GL_NV_register_combiners[12]**
  - **GL_ATIX_fragment_program**

OpenGL Shader Builder



System Integration

- Quartz on a texture
  - High quality 2D anti-aliased content on ARGB textures
- Video on a texture
  - Non power of 2 textures
  - YUV texture formats
- Window Compositor integration
  - Overlays on steroids
  - “Heads up” UI for 3d apps

Texture Upload Performance

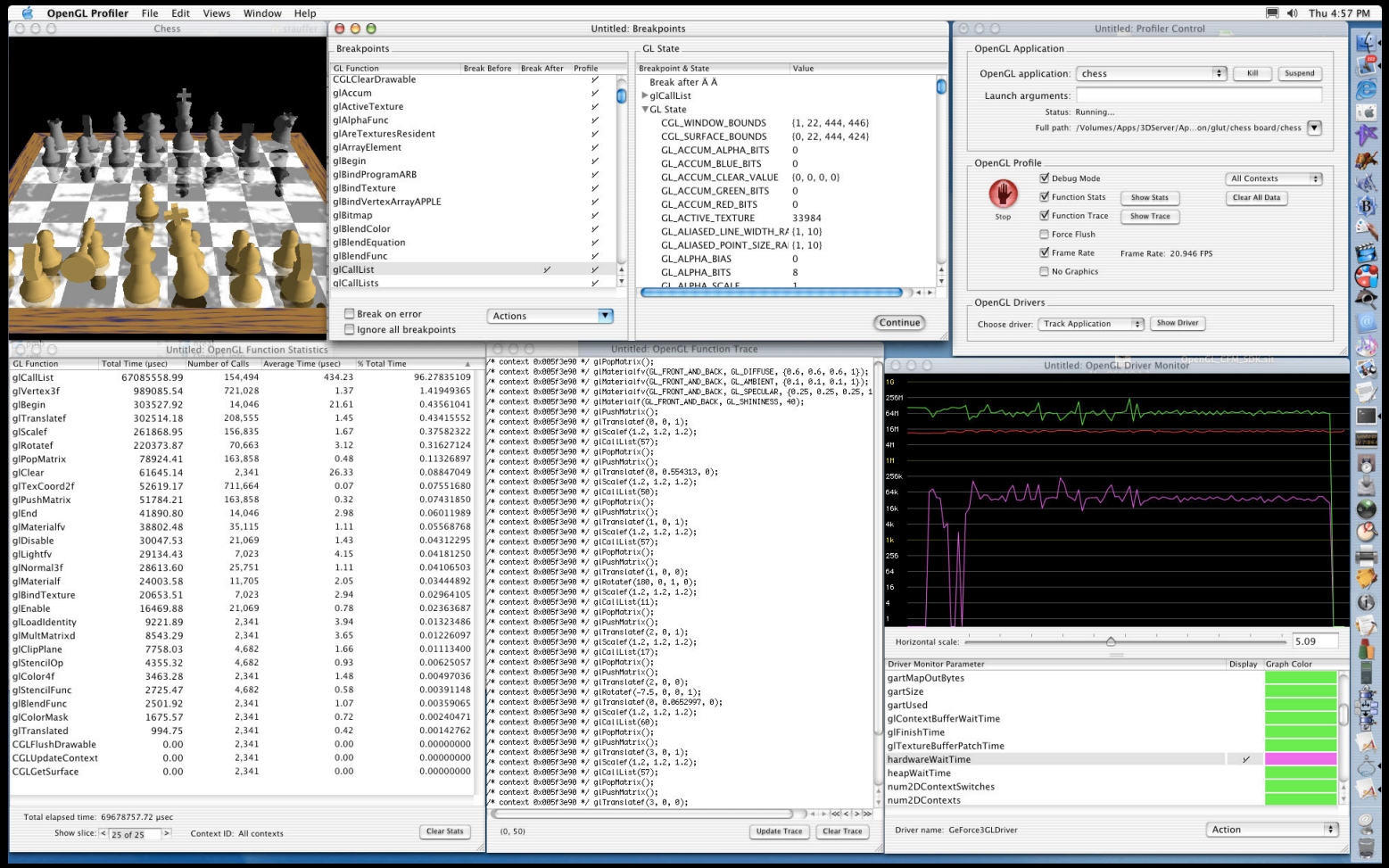
- Direct DMA from native texture formats
- No per pixel CPU involvement
- Flexible synchronization model
  - **GL_APPLE_fence**

New Extensions in Jaguar

GL_APPLE_ycbcr_422
GL_APPLE_texture_range
GL_APPLE_fence
GL_APPLE_vertex_array_range
GL_APPLE_vertex_array_object
GL_ARB_imaging
GL_ARB_texture_env_crossbar
GL_ARB_multisample
GL_ARB_point_parameters
GL_ARB_pipeline_program
GL_ARB_vertex_program
GL_ARB_texture_mirrored_repeat
GL_EXT_secondary_color
GL_EXT_fog_coord
GL_EXT_draw_range_elements
GL_EXT_stencil_wrap
GL_EXT_blend_func_separate

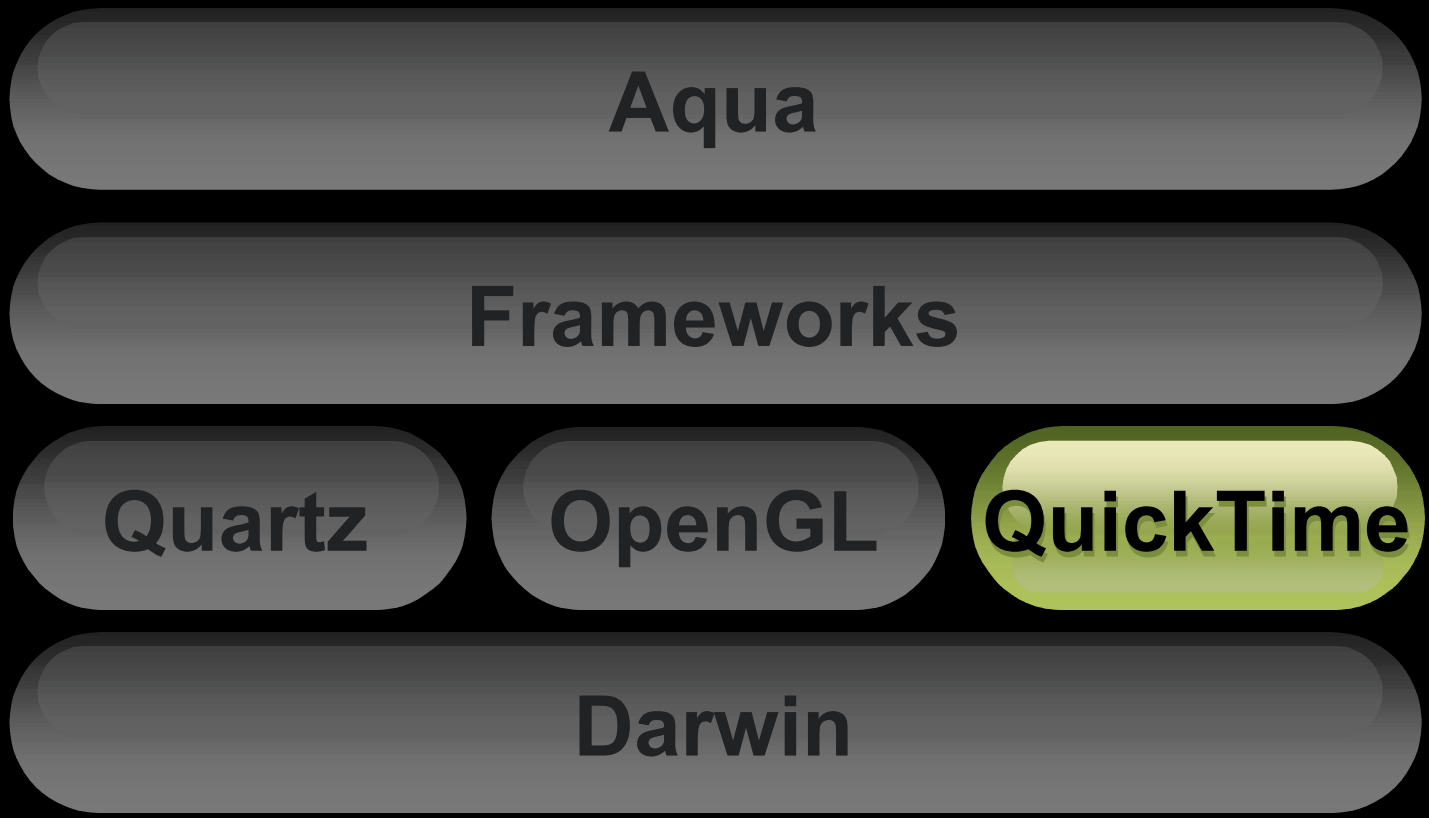
GL_SGIX_depth_texture
GL_SGIX_shadow
GL_ATI_texture_mirror_once
GL_ATIX_fragment_program
GL_ATI_blend_equation_separate
GL_ATI_blend_weighted_minmax
GL_NV_blend_square
GL_NV_fog_distance
GL_NV_multisample_filter_hint
GL_NV_point_sprite
GL_NV_texture_shader
GL_NV_texture_shader2
GL_NV_texture_shader3
GL_NV_depth_clamp

OpenGL Profiler



Open GL Roadmap

504 OpenGL: Graphics Programmability	Room A2 **Tue., 5:00pm**
505 OpenGL: Integrated Graphics 1 Putting OpenGL to work for you	Room J **Wed., 9:00am**
506 OpenGL: Integrated Graphics 2 Putting OpenGL to work for you	Room J **Wed., 10:30am**
513 OpenGL: Advanced 3D Latest extensions and techniques	Room J **Thurs., 3:30pm**
514 OpenGL: Performance Optimization	Room J **Thurs., 5:00pm**

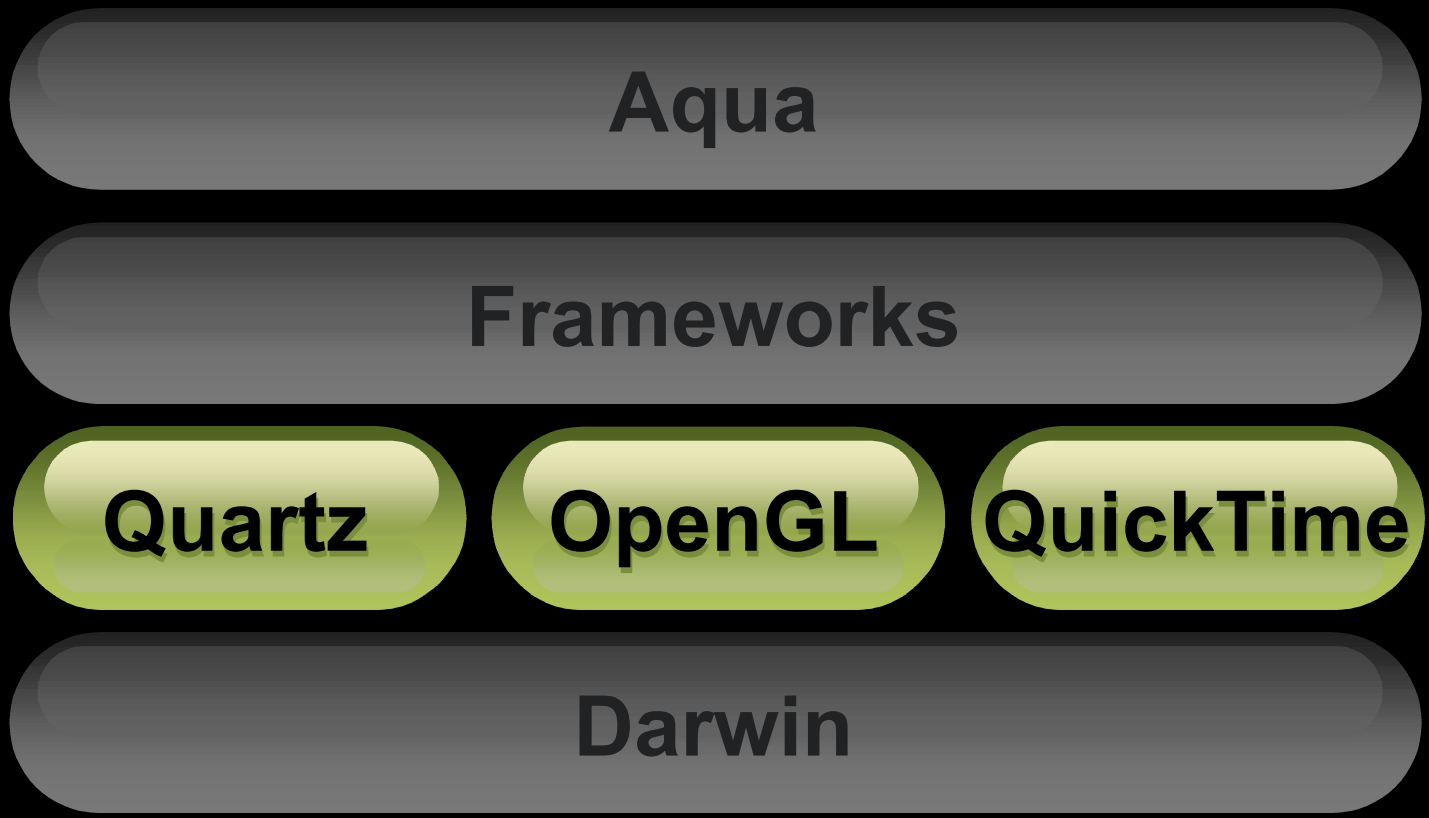

Aqua
Frameworks
Quartz
OpenGL
QuickTime
Darwin

QuickTime Roadmap

600 The State of QuickTime in 2002	Room A2 **Wed., 9:00am**
601 Building QuickTime Savvy Apps	Room A2 **Wed., 10:30am**
602 QuickTime for Video-Intensive Applications	Room A2 **Wed., 2:00pm**
603 Media Integration with QuickTime	Room A2 **Wed., 3:30pm**
604 Delivering Content via Interactive QuickTime	Room A2 **Wed., 5:00pm**

QuickTime Roadmap (Cont.)

FF010 Feedback Forum: QuickTime	Room J1 **Fri., 10:30am**
606 QuickTime for the Web	Room A2 **Fri., 2:00pm**
607 QuickTime and MPEG4: A Technical Overview	Room A2 **Fri., 3:30pm**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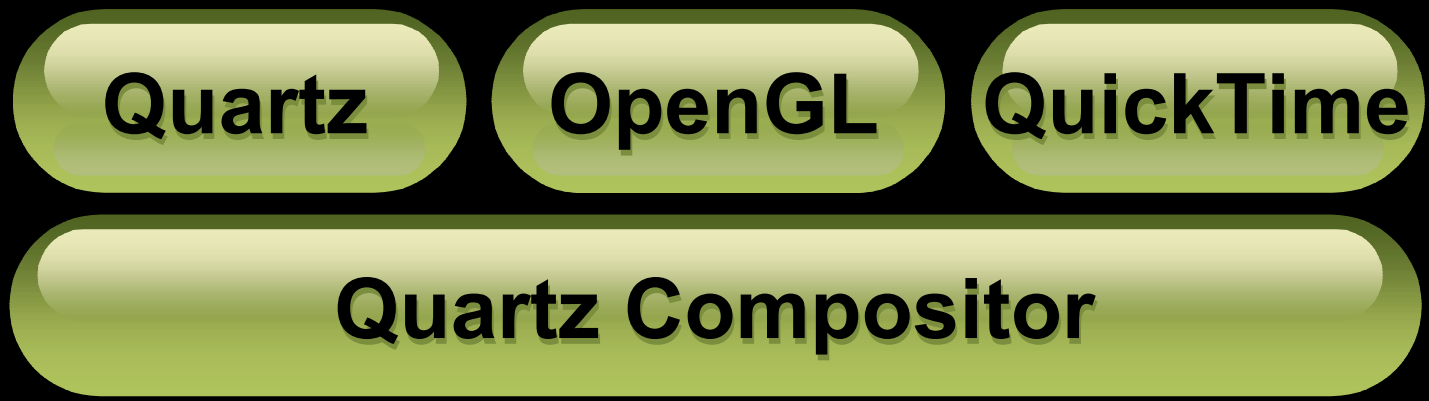
Quartz
OpenGL
QuickTime
Quartz Compositor

Window System as a Digital Image Compositor

Finder File Edit View Go Window Help

Fri 10:57 PM

Mac OS X

My Stuff HD

FireWire HD

iMac Window Ad.mov

00:00:21

PowerBook G4.pdf

verBook G4

Page 1

Page 2

Page 3

Page 4

Navigation

iTunes

620 Clock	0.0%	0:01.39	1	57	86	1.59M	5.45M	3.32M	166M
617 Previe	0.0%	0:26.67	2	68	144	3.83M	20.5M	12.7M	194M
595 Quick	0.0%	0:24.16	6	121	202	6.29M	11.4M	11.7M	186M
532	4.6%	3:28.21	1	16	20	236K	612K	564K	13.9M
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505 SecurityAg	0.0%	0:01.27	2	82	94	1.48M	5.59M	3.79M	166M
459 SystemUISe	0.0%	0:01.95	2	133	121	1.44M	5.77M	3.16M	162M
454 Dock	0.0%	0:14.16	2	101	136	1.48M	11.7M	8.50M	166M
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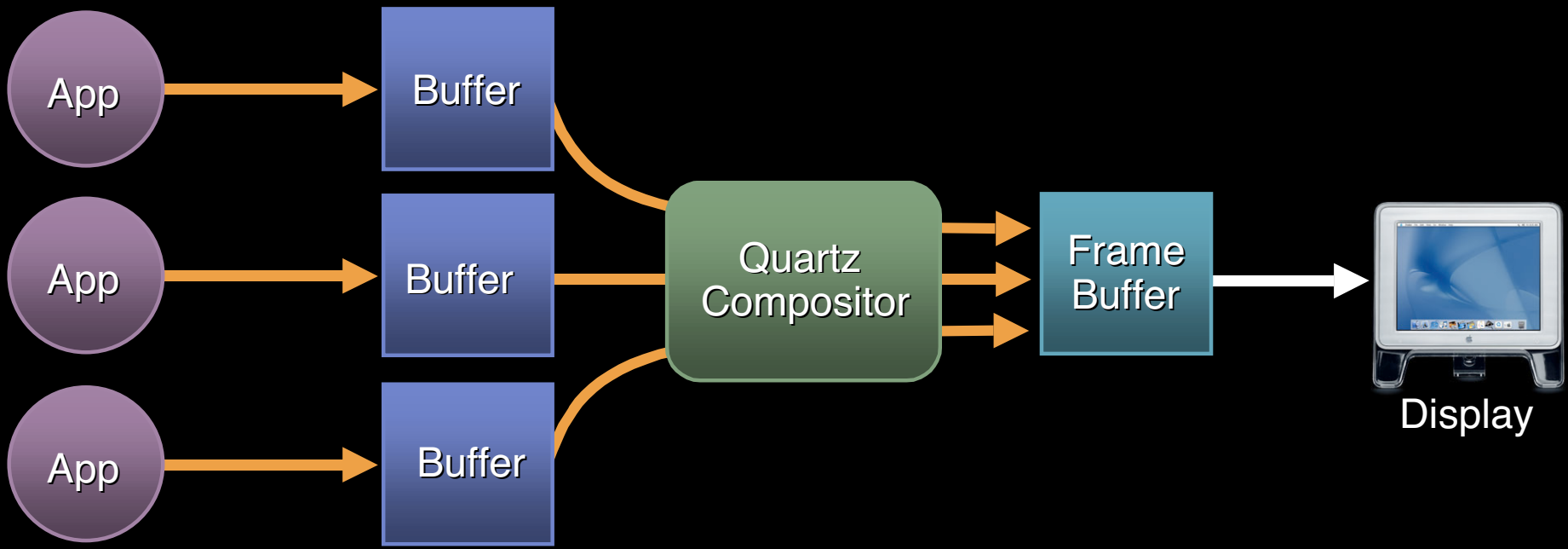
Demo

Quartz Compositor



But . . .

- Model can be computationally expensive
- “You took the framebuffer away . . .”
- We’ve built the foundation for the future
- Now we can complete the story . . .

NEW Quartz Extreme

- Implementation of Quartz Compositor on OpenGL
- Removes “transparency tax” for video and 3D
- Frees up CPU
- Showcases GPU in user interface
- Allows us to deliver even more dramatic UI advances

Demo

Programmed I/O vs. DMA

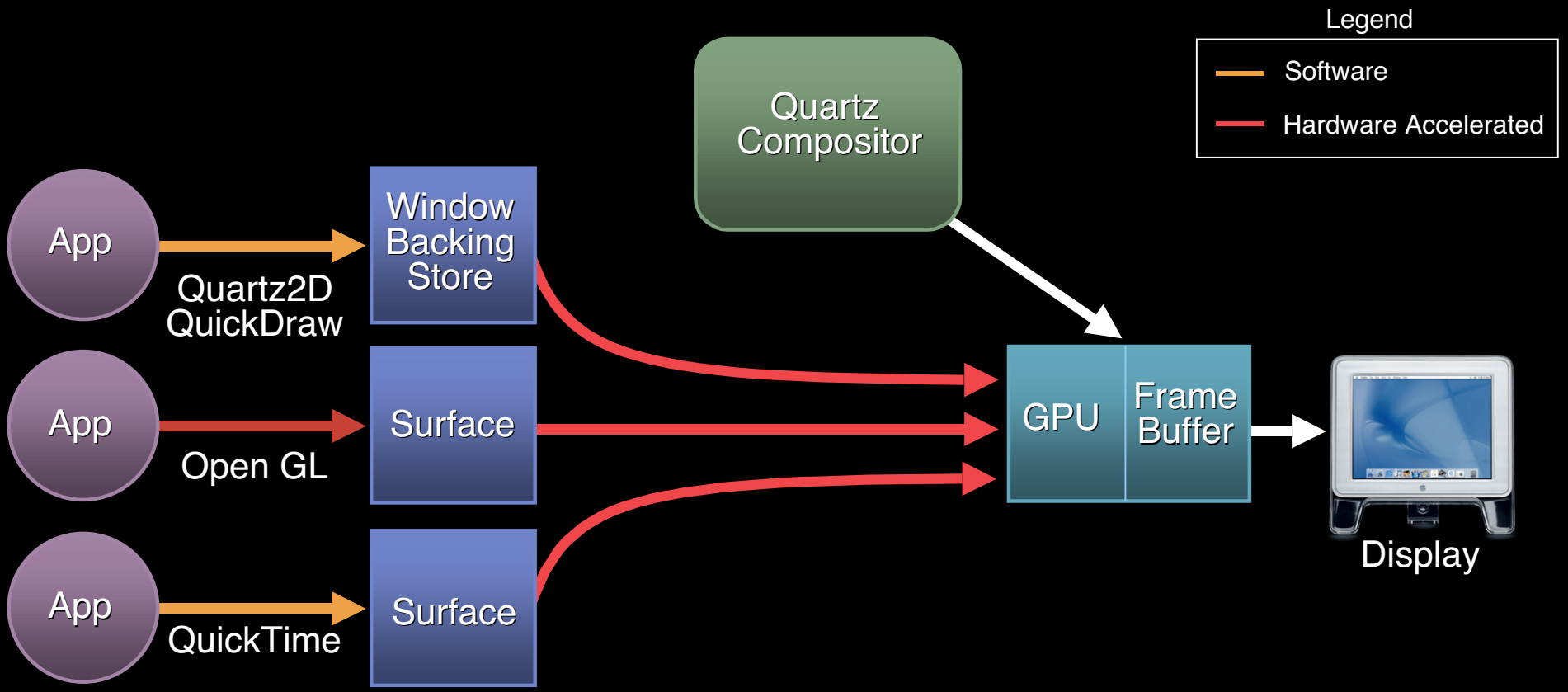
- Programmed I/O Model
  - CPU pushes data and commands to device
  - Inefficient use of CPU
- DMA I/O Model
  - Device pulls data and commands from memory
  - CPU and I/O occur in parallel
- CPU drawing in the framebuffer is really just programmed I/O!

More Moore's Law

- CPU
  - Performance doubles every 18 months
  - G4: 10 million transistors

- GPU
  - Performance doubles every 6 months
  - "Moore's law cubed"
  - GeForce4 Ti: 63 million transistors

Quartz Extreme

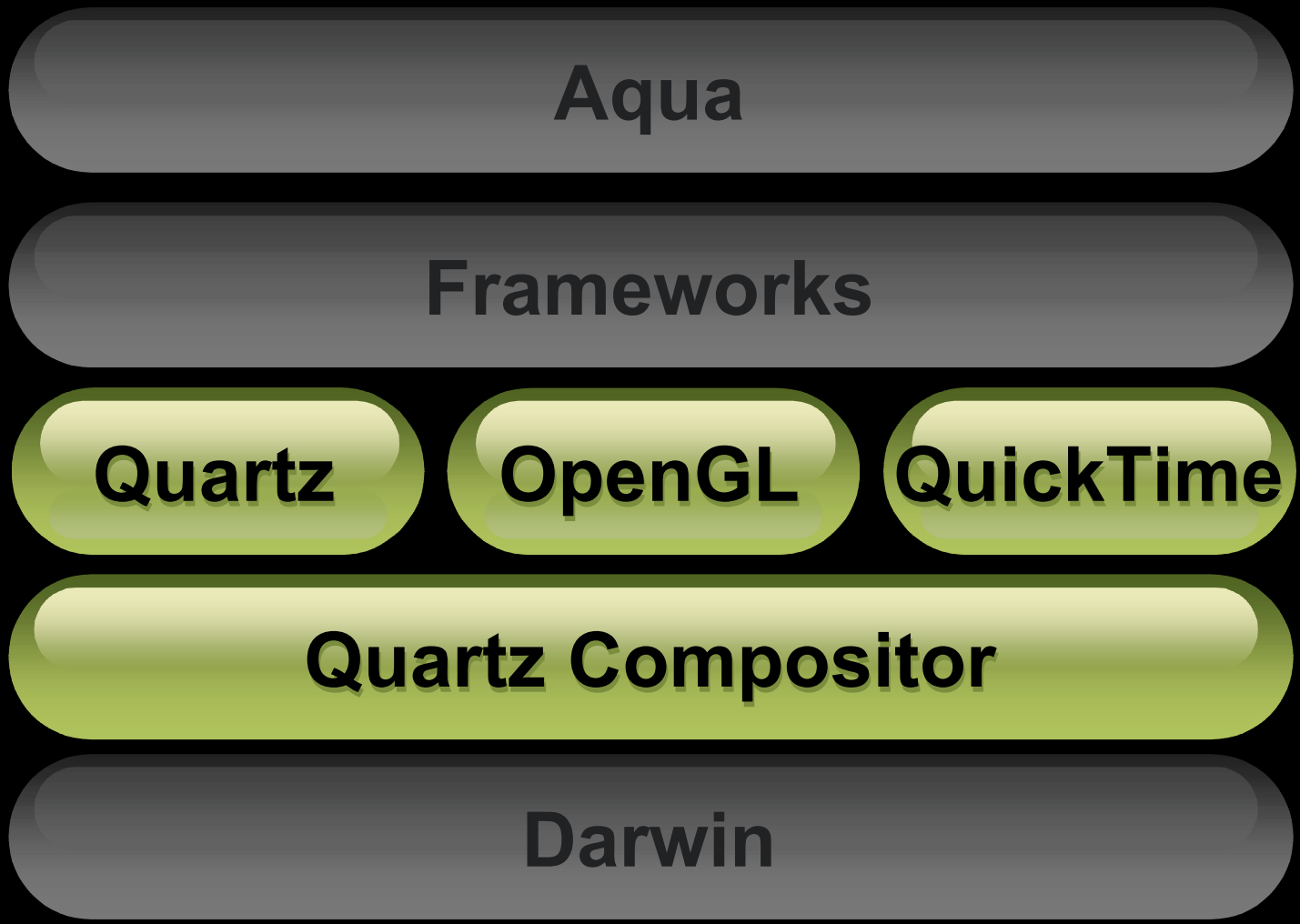


Apple Leading the Industry

- Natural evolution of windowing systems
- Lots of hacks out there, but we've done it right
- Inflection point in platform graphics architecture
- Our advances are directly useable by you via Jaguar OpenGL

Quartz Compositor Roadmap

503 Exploring the Quartz Compositor	Hall 2 **Tue., 3:30pm**
506 OpenGL: Integrated Graphics 2 Build Your Own Compositor!	Room J **Wed., 10:30am**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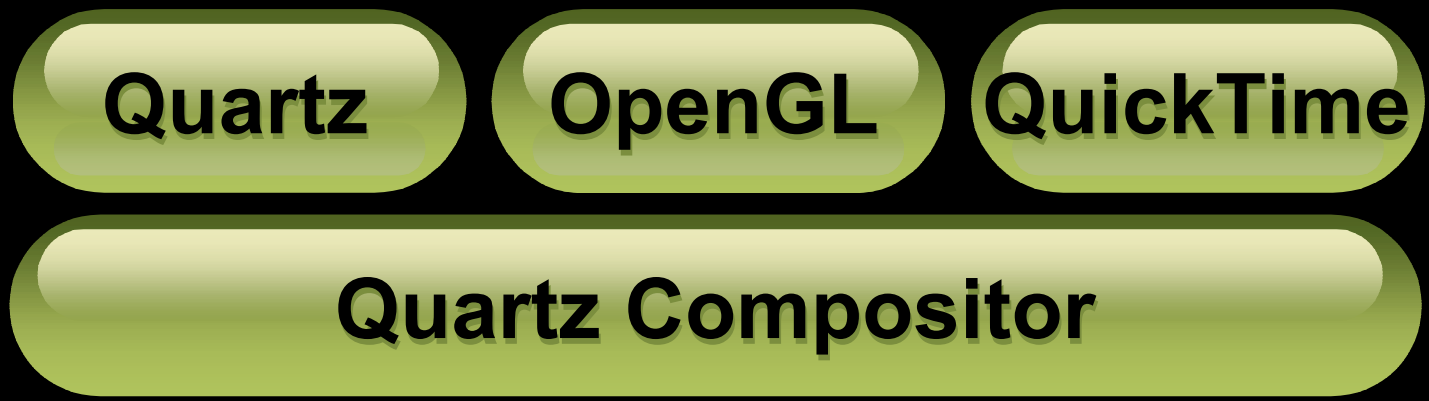
Quartz
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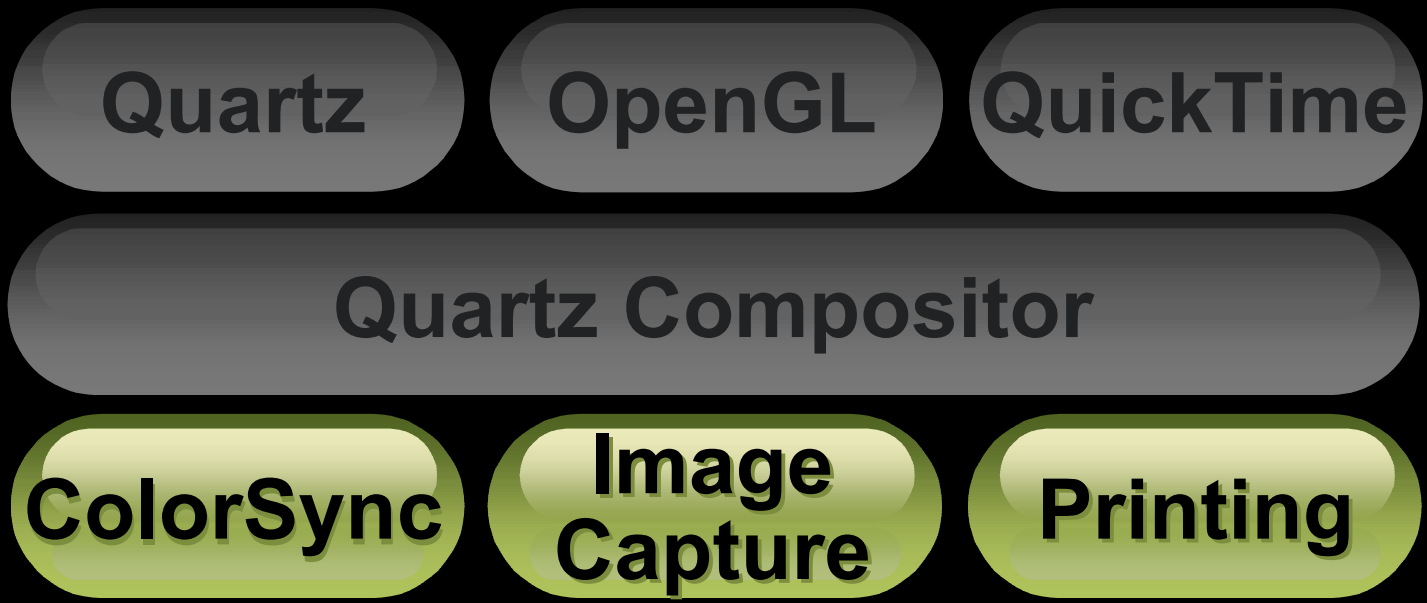
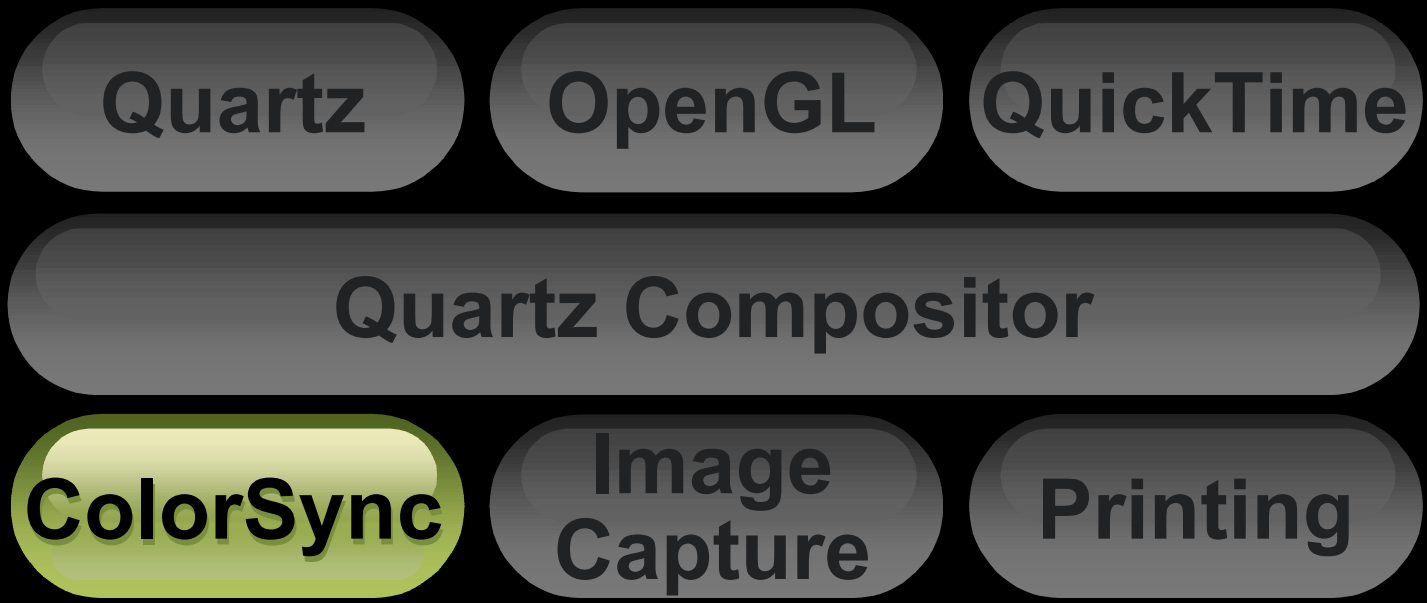

Quartz
OpenGL
QuickTime
Quartz Compositor
ColorSync
Image Capture
Printing


Quartz
OpenGL
QuickTime
Quartz Compositor
ColorSync
Image Capture
Printing

ColorSync

- ICC standard color matching
  - www.color.org
- Framework for color calculations
- Device transforms expressed as profiles
- Built into Quartz 2D
- Successfully used in print publishing
- Emerging for film and video

What's New in ColorSync

- Tuned for Velocity Engine
- ICC4
- Convenience Colorspaces for Quartz 2D
- Realtime RGBtoRGBA possible on GeForce4 Ti

Demo

ColorSync Roadmap

509 ColorSync and Digital Media:

Room C
Wed., 5:00pm

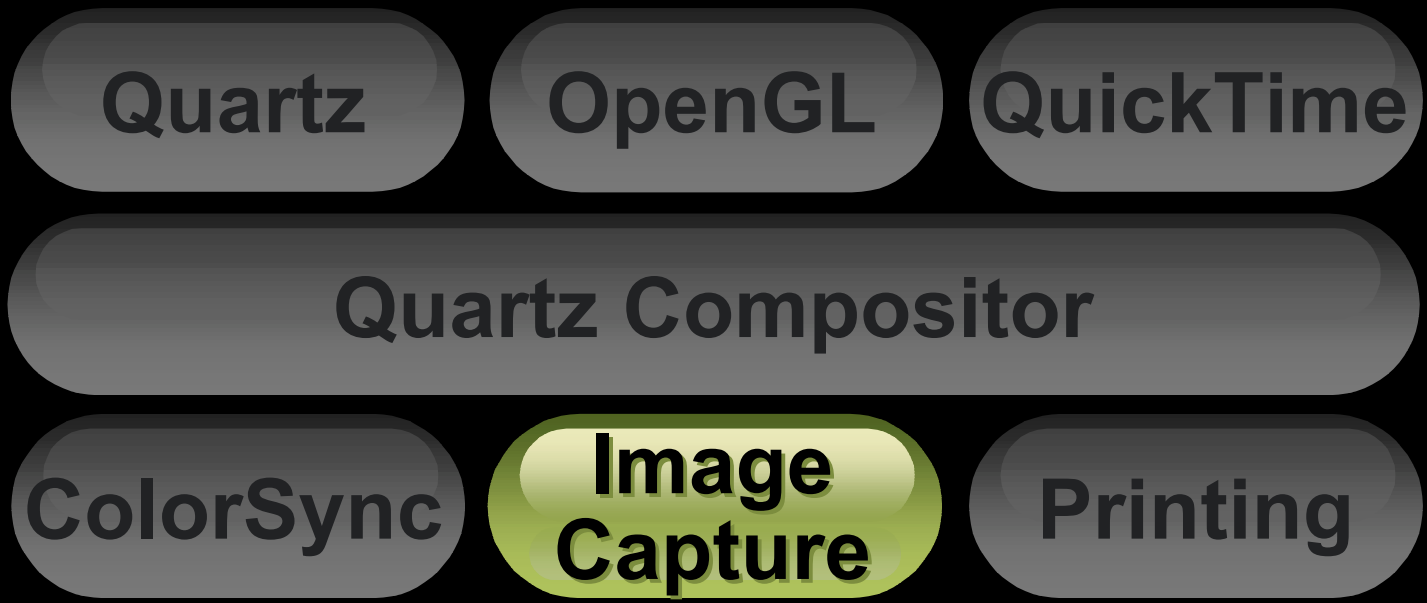

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Image Capture Workflow

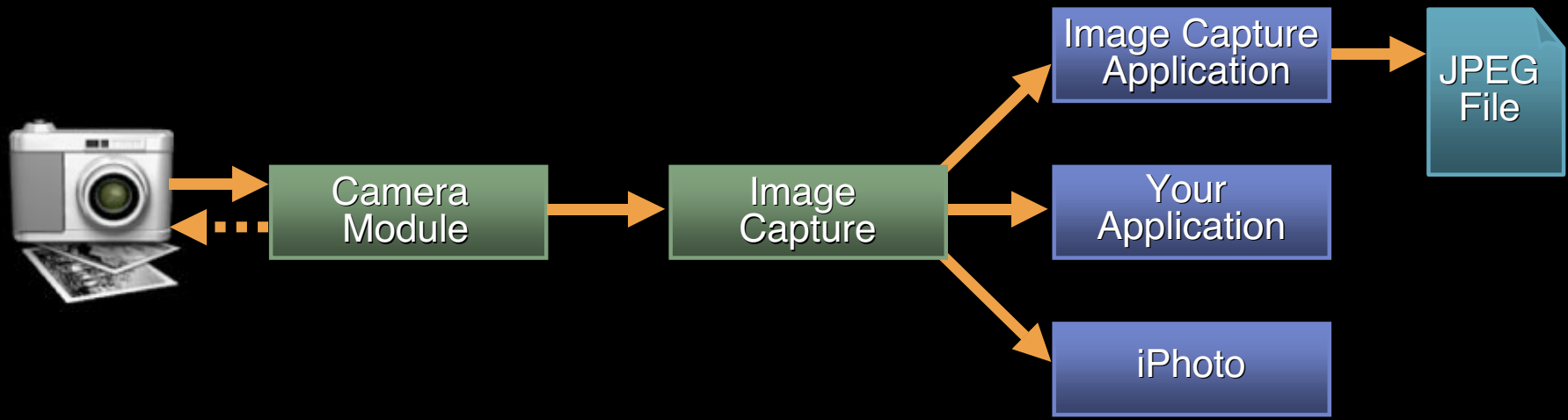
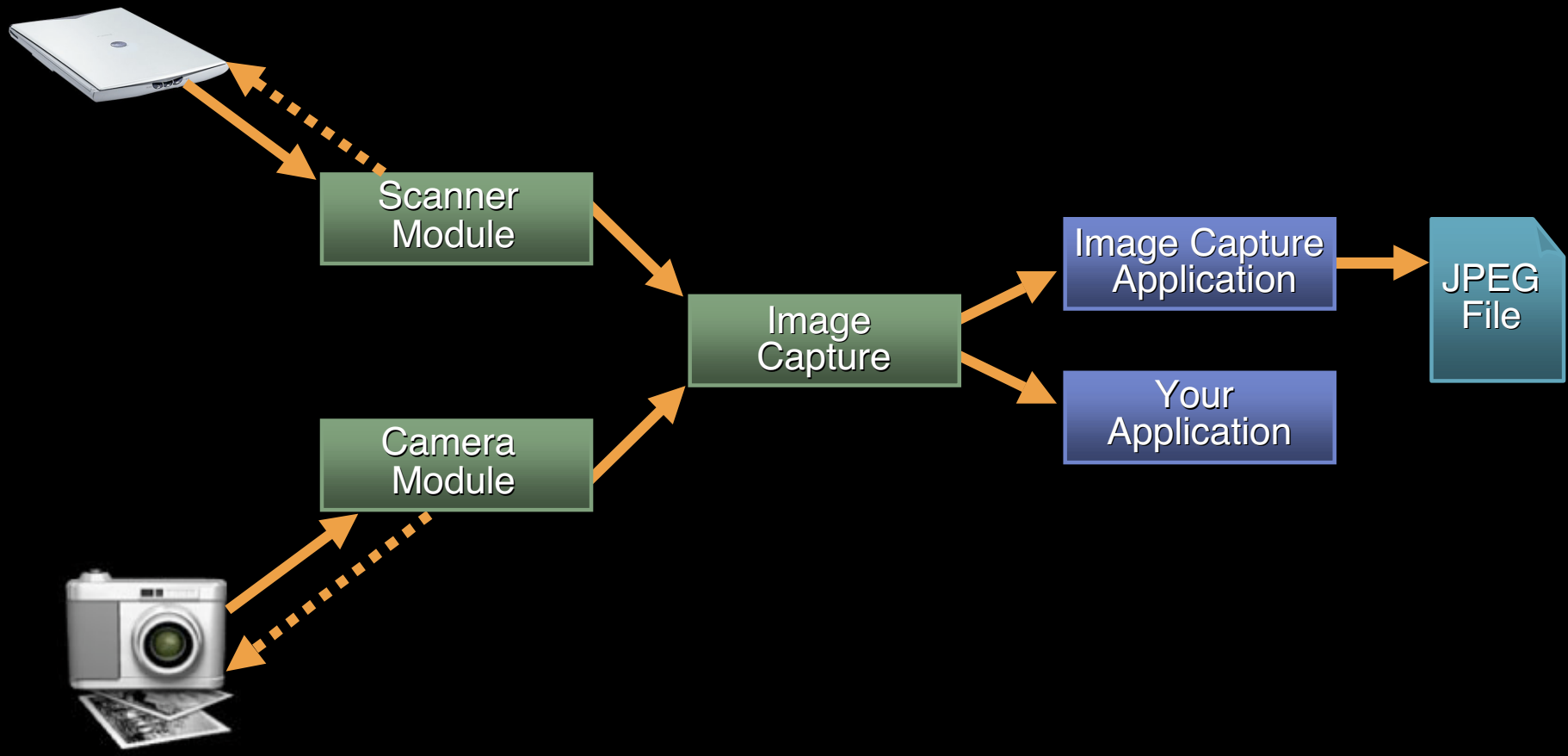


Image Capture Workflow



What's New in Image Capture

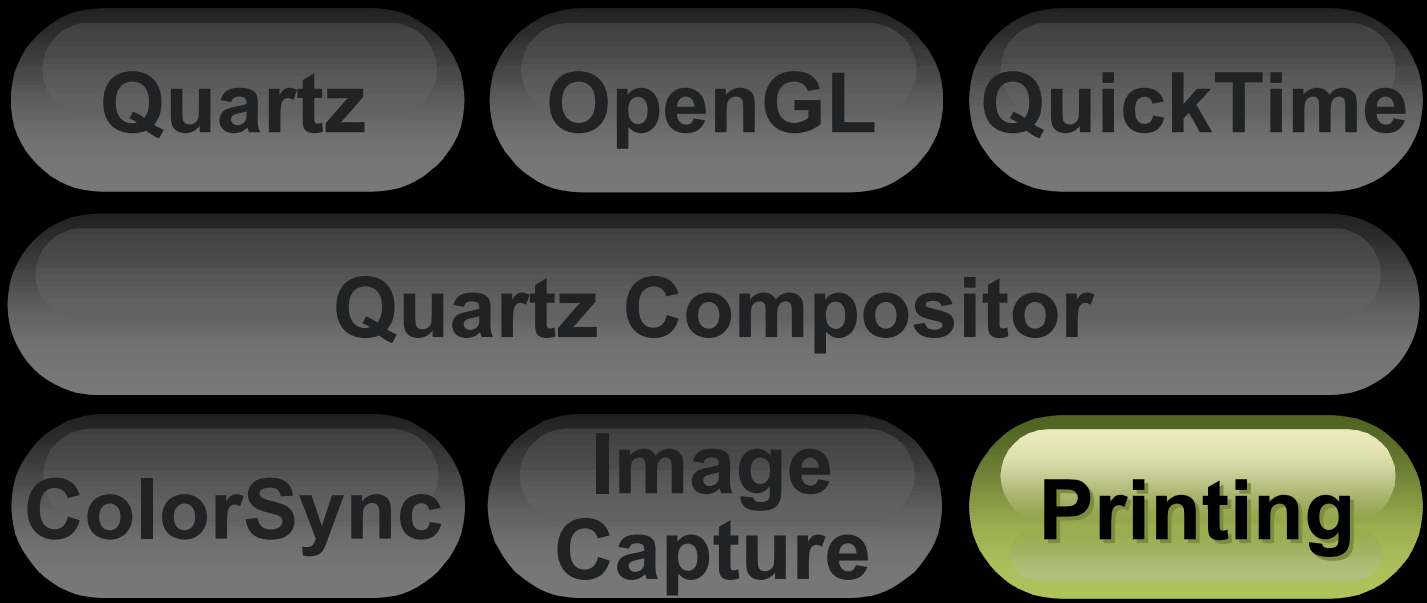
- Scanner support
- TWAIN
- Basic scanning UI
- FireWire camera support

Built-in Scanner UI

Image Capture Roadmap

515 Image Capture Framework

Room C
Fri., 2:00pm


Quartz
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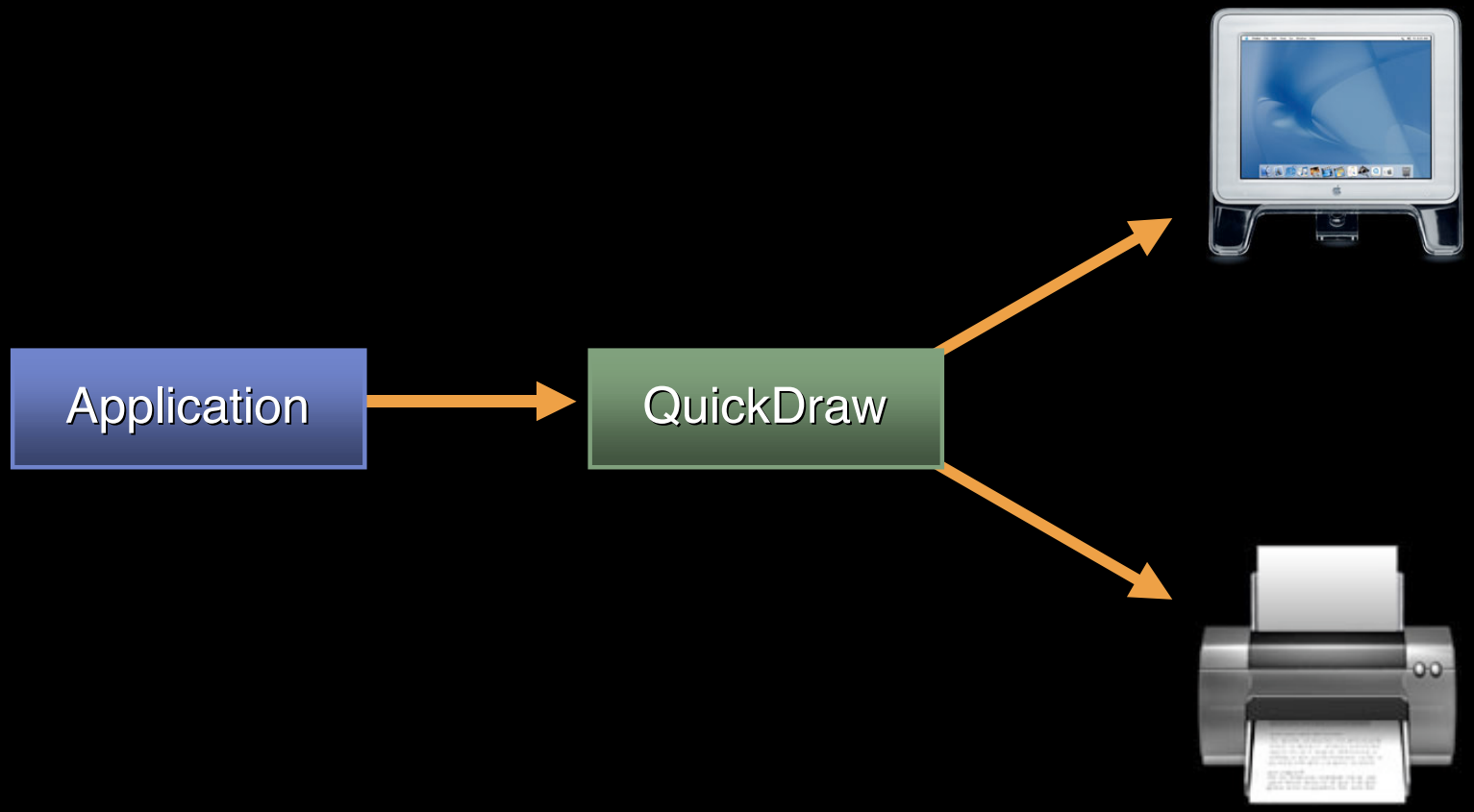
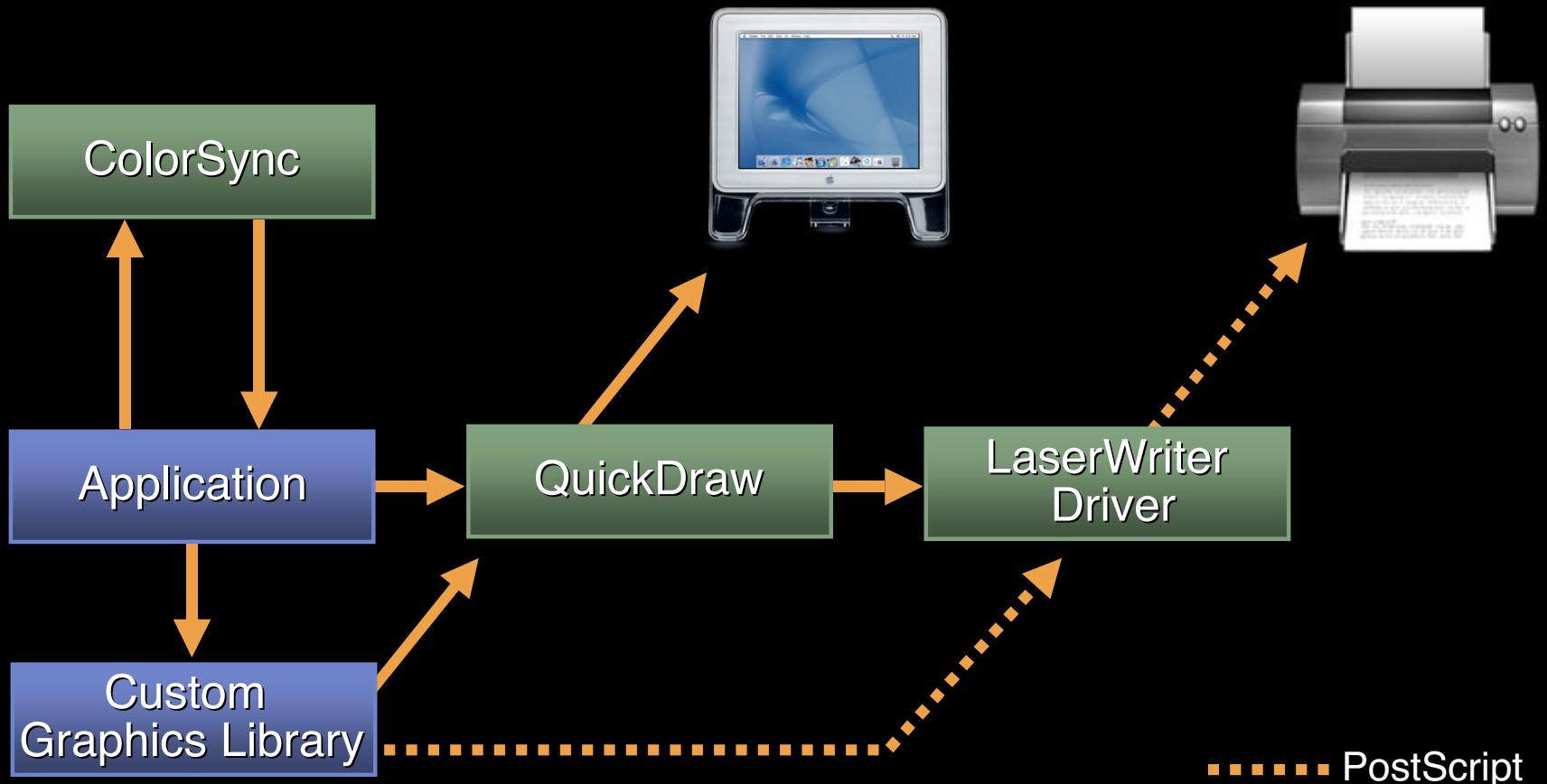
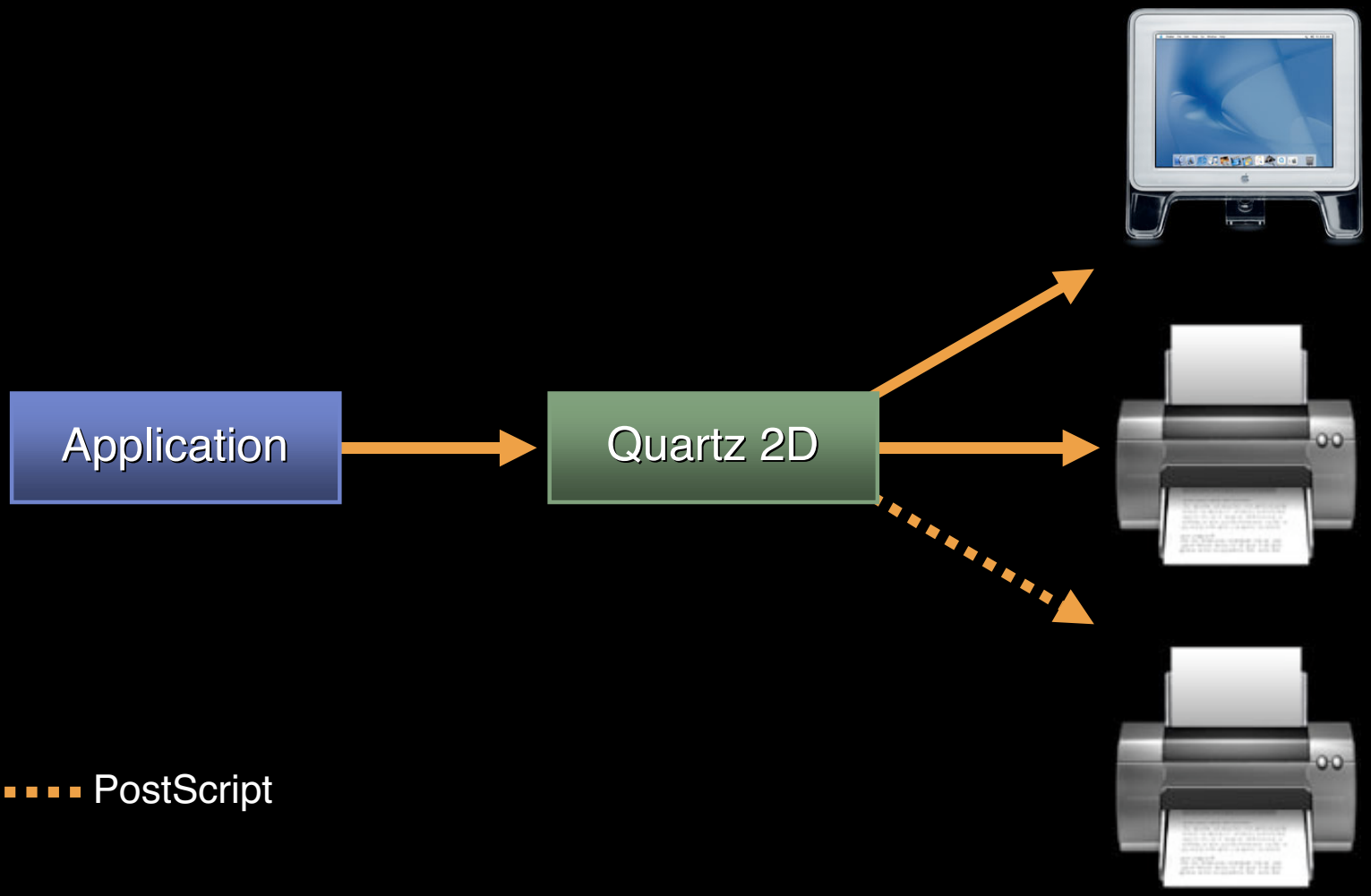
The Beginning: QuickDraw Does It All



The Reality: Postscript Was Required



Today: Printing With Quartz 2D



Quartz 2D

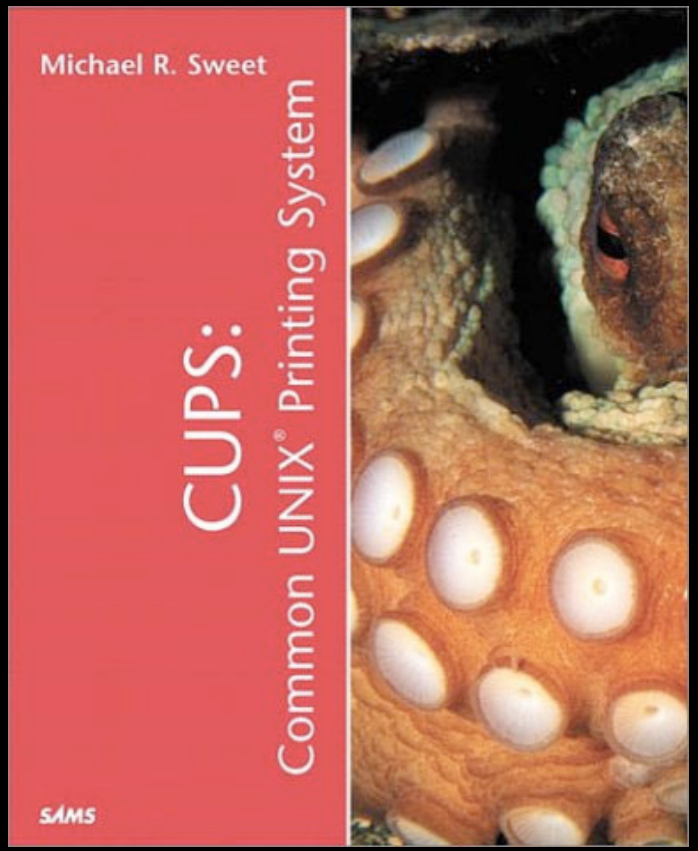
Quartz 2D

What's New in Printing

- Completely new OpenSource spooling system
- Binary compatible with 10.1 for Apps
- Binary compatible with 10.1 for drivers too!
- New features
  - Printer sharing via IPP
  - Cocoa Print Center

Common UNIX Printing System

- Printer Sharing via IPP
- UNIX lpr/lp suite
- Flexible architecture
- In several Linux distros
- www.cups.org



Demo

Printing Roadmap

510 Printing and Mac OS X: APIs and Architecture Update	Hall 2 **Thurs., 10:30am**
109 Darwin Printing: All About CUPS From Michael Sweet	Room J **Wed., 2:00pm**

Doc in the House

New documentation since WWDC ’01

- 1000’s of pages of new or revised documentation
  - 8+ revised books
  - 38 new Q&As
  - 4 new Technotes
  - 78 new code samples
  - Full set of OpenGL man pages

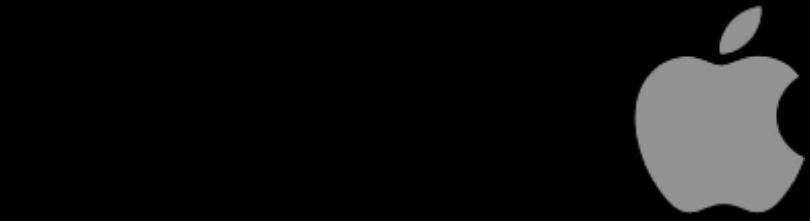
Documentation > Core Technologies > Graphics

http://developer.apple.com/techpubs/macosx/CoreTechnologies/coretechnologies.html

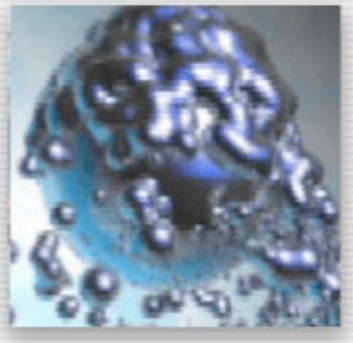
Feedback

FF018 Graphics and Imaging

Room J1
Fri., 5:00pm



Q&A



Travis Brown
Graphics and Imaging Evangelist
Worldwide Developer Relations

http://developer.apple.com/wwdc2002/urls.html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